

CLAIMS:

1. A pharmaceutical composition comprising a compound, salt, solvate, or stereoisomer of a synthetic c-di-AMP, and a pharmaceutically acceptable carrier.
2. A pharmaceutical composition comprising a compound, salt, solvate, or stereoisomer of a synthetic c-di-AMP, and at least one or more other compounds enhancing immunogenicity, and a pharmaceutically acceptable carrier.
3. The pharmaceutical composition of Claim 2 wherein the compounds enhancing immunogenicity is selected from the group consisting of mycobacterial DNA, IFN, or combinations thereof.
4. A method of treating a bacterial infection in a subject comprising administering to the subject an effective amount of a compound, salt, solvate, or stereoisomer of synthetic c-di-AMP.
5. A method of treating TB in a subject comprising administering an effective amount of a compound, salt, solvate, or stereoisomer of c-di-AMP.
6. A pharmaceutical composition comprising a strain of *Mycobacterium* comprising an expression vector encoding a di-adenylate cyclase enzyme or functional part thereof, and a pharmaceutically acceptable carrier.
7. The pharmaceutical composition of claim 6 wherein the strain of *Mycobacterium* is selected from the group consisting of *Mycobacterium tuberculosis* or *Mycobacterium bovis*, or a combination thereof.
8. The pharmaceutical composition of claim 7 wherein the strain of *Mycobacterium* is BCG.
9. The pharmaceutical composition of claim 6 wherein the expression vector is a mycobacterial expression vector.
10. The pharmaceutical composition of claim 9 wherein the expression vector comprises the DNA sequence of diadenylate cyclase (disA), or a functional part thereof.
11. The pharmaceutical composition of claim 10, wherein the disA is that of *M. tuberculosis* (Rv3586).
12. A pharmaceutical composition of claim 6 wherein the expression vector comprises a hsp60 promoter.

13. The method of claim 12 wherein the expression of di-adenylate cyclase enzyme or functional part thereof is regulated by the hsp60 promoter.
14. A pharmaceutical composition comprising a strain of *Mycobacterium* comprising an expression vector encoding a di-adenylate cyclase enzyme, or a functional part thereof, and at least one or more compounds enhancing immunogenicity, and a pharmaceutically acceptable carrier.
15. The pharmaceutical composition of claim 14 wherein the strain of *Mycobacterium* is selected from the group consisting of *Mycobacterium tuberculosis*, *Mycobacterium bovis*, or a combination thereof.
16. The pharmaceutical composition of claim 15 wherein the strain of *Mycobacterium* is BCG.
17. The pharmaceutical composition of claim 14 wherein the expression vector is a mycobacterial expression vector.
18. The pharmaceutical composition of claim 17 wherein the expression vector comprises the DNA sequence of diadenylate cyclase (*disA*), or a functional part thereof.
19. The pharmaceutical composition of claim 17, wherein the *disA* is that of *M. tuberculosis* (Rv3586).
20. A pharmaceutical composition of claim 14 wherein the expression vector comprises a hsp60 promoter.
21. The pharmaceutical composition of Claim 14 wherein the at least one of more compounds enhancing immunogenicity is synthetic c-di-AMP.
22. The pharmaceutical composition of Claim 14 wherein the at least one or more compounds enhancing immunogenicity is selected from the group consisting of mycobacterial DNA, IFN, or combinations thereof.
23. A method of vaccinating a subject against TB comprising administering to the subject an effective amount of a strain of *Mycobacterium* comprising an expression vector encoding a di-adenylate cyclase enzyme or functional part thereof and a pharmaceutically acceptable carrier.
24. The method of claim 23 wherein the strain of *Mycobacterium* is selected from the group consisting of *Mycobacterium tuberculosis*, *Mycobacterium bovis*, or a combination thereof.

25. The method of claim 24 wherein the strain of *Mycobacterium* is BCG.
26. The method of claim 23 wherein the expression vector is a mycobacterial expression vector.
27. The method of claim 26 wherein the expression vector comprises the DNA sequence of diadenylate cyclase (*disA*), or a functional part thereof.
28. The method of claim 27, wherein the *disA* is that of *M.tuberculosis* (Rv3586).
29. The method of claim 23 wherein the expression vector comprises a *hsp60* promoter.
30. The method of claim 29 wherein the expression of di-adenylate cyclase enzyme or functional part thereof is regulated by the *hsp60* promoter.
31. A method of vaccinating a subject against TB comprising administering to the subject and effective amount of a strain of *Mycobacterium* over-expressing diadenylate cyclase (*disA*), and at least one or more other compounds enhancing immunogenicity, and a pharmaceutically acceptable carrier.
32. A method of treating or preventing cancer in a subject comprising administering to the subject an effective amount of a strain of *Mycobacterium* comprising an expression vector encoding a di-adenylate cyclase enzyme or a functional part thereof and a pharmaceutically acceptable carrier.
33. The method of claim 32 wherein the strain of *Mycobacterium* is selected from the group consisting of *Mycobacterium tuberculosis*, *Mycobacterium bovis*, or a combination thereof.
34. The method of claim 33 wherein the strain of *Mycobacterium* is BCG.
35. The method of claim 32 wherein the expression vector is a mycobacterial expression vector.
36. The method of claim 35 wherein the expression vector comprises the DNA sequence of diadenylate cyclase (*disA*), or a functional part thereof.
37. The method of claim 36, wherein the *disA* is that of *M.tuberculosis* (Rv3586).
38. The method of claim 26 wherein the expression vector comprises a *hsp60* promoter.
39. The method of claim 38 wherein the expression of di-adenylate cyclase enzyme or functional part thereof is regulated by the *hsp60* promoter.
40. The method of claim 32 wherein the cancer is nonmuscle invasive bladder cancer.

41. A method of treating or preventing cancer in a subject comprising administering to the subject an effective amount of a strain of *Mycobacterium* over-expressing diadenylate cyclase (*disA*), and at least one or more other compounds enhancing immunogenicity, and a pharmaceutically acceptable carrier.
42. The method of claim 41 wherein the strain of *Mycobacterium* is selected from the group consisting of *Mycobacterium tuberculosis*, *Mycobacterium bovis*, or a combination thereof.
43. The pharmaceutical composition of claim 42 wherein the strain of *Mycobacterium* is BCG.
44. The method of claim 41 wherein the at least one or more other compounds enhancing immunogenicity is c-di-AMP.
45. The method of Claim 41 wherein the at least one or more compounds enhancing immunogenicity is selected from the group consisting of mycobacterial DNA, IFN, or combinations thereof.
46. The method of claim 41 wherein the expression vector is a mycobacterial expression vector.
47. The method of claim 46 wherein the expression vector comprises the DNA sequence of diadenylate cyclase (*disA*), or a functional part thereof.
48. The method of claim 47, wherein the *disA* is that of *M.tuberculosis* (Rv3586).
49. The method of claim 41 wherein the expression vector comprises a hsp60 promoter.
50. The method of claim 49 wherein the expression of di-adenylate cyclase enzyme or functional part thereof is regulated by the hsp60 promoter.
51. A strain of *Mycobacterium* comprising an expression vector encoding a di-adenylate cyclase enzyme.
52. The strain of claim 51, wherein the *Mycobacterium* is selected from the group consisting of *Mycobacterium tuberculosis*, *Mycobacterium bovis*, or a combination thereof.
53. The strain of claim 52 wherein the strain of *Mycobacterium* is BCG.
54. The method of claim 41 wherein the expression vector is a mycobacterial expression vector.
55. The strain of claim 54 wherein the expression vector comprises the DNA sequence of diadenylate cyclase (*disA*), or a functional part thereof.

- 56. The strain of claim 55, wherein the *disA* is that of *M.tuberculosis* (Rv3586).
- 57. The strain of claim 51 wherein the expression vector comprises a *hsp60* promoter.
- 58. The strain of claim 57 wherein the expression of di-adenylate cyclase enzyme or functional part thereof is regulated by the *hsp60* promoter.